

USING RADIOTRACERS TO DETERMINE RESIDUAL OIL SATURATION (CPR/8/010)

F5 New

MODEL PROJECT

CORE FINANCING

YEAR	Experts		Group Activity	Equipment	Fellowships		Scientific Visits		Group Training	Sub-Contracts	Misc. Comp.	TOTAL
	m/d	US \$	US \$	US \$	m/d	US \$	m/d	US \$	US \$	US \$	US \$	US \$
1999	1/7	18,130	0	98,000	4/0	13,800	0/15	5,400	0	0	0	135,330
2000	0/22	11,330	0	50,000	4/0	14,400	0/0	0	0	0	0	75,730
2001	0/15	8,100	0	20,000	0/0	0	0/0	0	0	0	0	28,100

FOOTNOTE a/ FINANCING

YEAR	Experts		Group Activity	Equipment	Fellowships		Scientific Visits		Group Training	Sub-Contracts	Misc. Comp.	TOTAL
	m/d	US \$	US \$	US \$	m/d	US \$	m/d	US \$	US \$	US \$	US \$	US \$
2000	0/0	0	0	48,000	0/0	0	0/0	0	0	0	0	48,000

First Year Approved: 1999

OBJECTIVES: To refine the radiotracer technology and methodology for determining residual oil in oil fields; to apply QA and QC to tracer preparation and validation, including a radiotracer preparation protocol; to improve and standardize data processing and interpretation to facilitate transfer to end users for large scale application to 20-30 operating oil fields; and to validate computer modeling of field parameter evaluation.

BACKGROUND: The China Institute of Atomic Energy (CIAE) has accumulated experience in applying radiotracer technology to oil field development. The results from the previous TC project CPR/8/004: "Tracer Studies for Monitoring Potential Zones in Oil Fields" (1988 - 1990), have enabled CIAE to establish some tracer techniques and created an infrastructure and capability for using tracers. The benefit of the technology was demonstrated to participants of an RCA workshop on tracers at the Dagang oil field. Co-operation between nuclear researchers and oil field engineers is already established. The petroleum industry - China National Petroleum Corporation (CNPC) and the Dagang Oil Field Group Ltd. - requires powerful tools for reservoir characterization to meet day-to-day estimations for the secondary and tertiary recovery stages. Since most reserves have to be recovered by high-water cut, it is important to evaluate residual oil available in the water flooding reservoir. The technique - the interwell tracer test (IWTT) - is based on the application of tracer partitioning, whereby at least two tracers with different oil-water partitioning coefficients are injected into the reservoir. Using the difference of mean residence time between the two tracers, the residual oil saturation can be calculated. As most reservoirs in China are continental sediments with a complex geological structure, the IWTT is attractive because it provides reliable data instantaneously.

PROJECT PLAN: Phase I: 1. Refinement of the basic methodology of tracer applications in oil field development - laboratory investigation (January-August 1999): (i) Preparation of primary tracer pair and their QC. Preparation of new tracers: H-3, C-14, S-35, etc.; (ii) Provision of liquid chromatography system; (iii) Partition coefficient determination of various tracers with liquid chromatography system; (iv) Expert mission on partitioning tracer preparation and their QC, and training in tracer methodology in oil field and in development of new tracers. 2. Validation of tracers in oil field experiments at Dagang (September 1999-May 2000): (i) Experimental design of interwell radiotracer investigation with multitracer technique, site location and choice of well groups; (ii) Expert mission for execution and validation of field tracer experiments; (iii) Development of low concentration multitracer analysis technique; (iv) Adoption of liquid scintillation counting system for low activity measurement; (v) Execution of two pilot experiments for tracer validation at Dagang oil field; (vi) Expert training in software applications for interwell tracer studies; (vii) Data processing and other calculations for residual oil estimation and

pore volume estimation. Final data presentation and mapping; (viii) Provision of computer software system for tracer response data calculation, data curve analysis, measurement of chromatographic delays between partitioning and non-partitioning tracers, pore volume estimation, residual oil estimation, and final data presentation in 2D and 3D presentations; (ix) Training in data processing and interpretation; (x) Scientific visit on tracer technology to oil fields in USA and Canada. 3. On-the-job demonstration of tracer technology for determination of residual oil saturation in the waterflooded oil field (June - December 2000): (i) Two real scale experiments in Dagang for problem solving and demonstration to 20 other oil field end users from all China; (ii) Expert mission to assist in full scale demonstration of tracer technology in oil fields to end users; (iii) National seminar on new applications of tracer technology in oil field development, case studies from Chinese experience. Phase II - 2001: 1. On-the-job demonstration to several end users of tracer technology for residual oil determination; 2. Provision of gamma spectrometric system to Dagang oil field to increase efficiency in routine applications of tracer technology; 3. Start of training for end users' engineers and tracer specialists in tracer technology for oil field development; publication of manual; 4. Organization of an RCA regional training course to transfer the technology to other RCA Member States.

NATIONAL COMMITMENT: The main counterpart institutions are the Isotope Department of CIAE; the Development Bureau of CNPC; and Dagang Oil Field Ltd., and the project is part of China's ninth national five-year programme, "The Comprehensive Administration of High Water Cut Reservoir". The number and qualifications of counterpart staff to be made available are considered adequate and the basic requirements for laboratories, office space, and experimental fields will be fully met.

AGENCY INPUT: The Agency will provide support through provision of expert services, specific equipment/materials; fellowships and scientific visits.

PROJECT IMPACT: The main impact is the creation of a capability to meet to the country's needs in tracer technology applications for enhancement of oil production. The project will also enhance the establishment of a permanent centre for tracers in oil field development at the Isotope Department of CIAE, and of a model field experimental station at Dagang oil field. The experience gained will be transferred to other oil field stations in China. The national resource centre at CIAE will prepare and distribute the appropriate radiotracers, develop standard technical packages and software for data processing and interpretation as applied to secondary and tertiary recovery methods, and provide on-the-job training to oil field end users. It could also be used as an RCA resource centre to transfer the technology to other RCA Member States.